PATENT ABSTRACTS OF JAPAN

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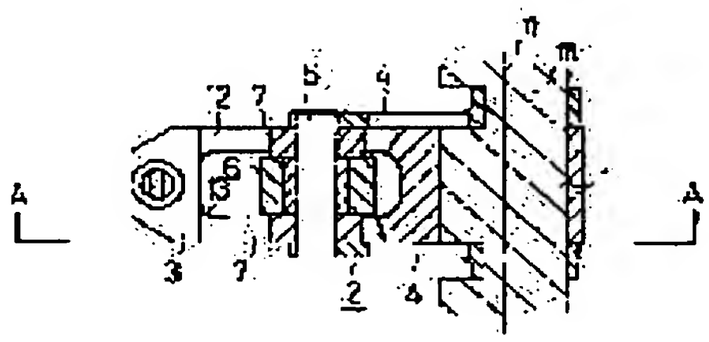
(54) VARIABLE VALVE SYSTEM MECHANISM OF INTERNAL COMBUSTION ENGINE

(57)Abstract:
PURPOSE: To secure periodicity of lift characteristic, and to obtain the different operation angle having a smooth lift curved line without the increase of inertial mass of a movement part.
CONSTITUTION: The arm piece 4 of an oscillation arm 2 is rotatably arranged to the eccentric shaft part 1a of a rocker shaft 1. A needle roller 6 and a pressing roller 5 are rotatably supported on the tip of the arm piece 4. The rotational shaft center of the rocker arm 3 is concentric with the rotational shaft center (n) of the rocker shaft 1. The tip of the rocker arm 3 presses a tappet 8 downward. A cam shaft 10 provided with a cam 11 for driving a needle roller 11 is arranged above the rocker arm 3 in parallel with the rocker shaft 1. The upper surface of the rocker arm 3 is formed on a curved surface 12 formed into a circular shape in its cross section, and the curved surface 12 is arranged on the circle taking the rotational shaft center O of the cam 11 as its center, and having the radius R. And the pressing roller 7 of the oscillation arm 2 is placed on the curved surface 12 so as to be able to roll.

(a)



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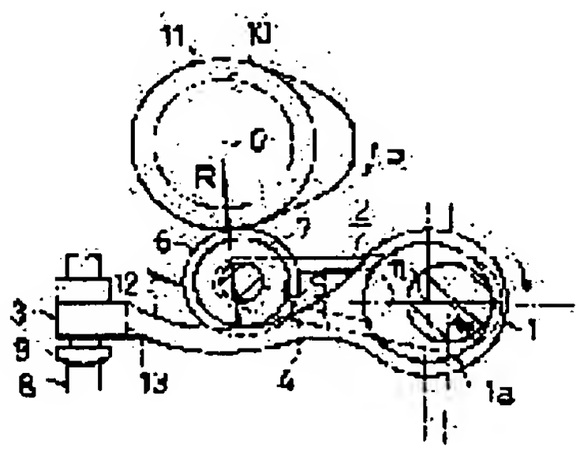

LEGAL STATUS

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
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[Date of registration]	28.07.2000
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[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

.* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the adjustable valve gear of the rocker arm method with which the sliding section in which contact sliding is possible has been arranged to a rocker arm and the swinging arm arranged between cams at both the rocker arm and the cam while the end was supported with the eccentric shaft The adjustable valve gear of the internal combustion engine characterized by having a synchronous revolution means to carry out the synchronous revolution of said eccentric shaft with the cam shaft of said cam, and a phase adjustable means to change the revolution phase of said eccentric shaft to a predetermined phase.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the adjustable valve gear of the internal combustion engine which makes adjustable continuously closing motion timing of an intake valve or an exhaust air bulb according to an internal combustion engine's operational status.
[0002]
[Description of the Prior Art] The movable valve system to which a working angle is changed with the eccentric arm of a couple as conventionally shown in JP,62-137313,U and JP,62-137314,U is proposed. In JP,62-137313,U, as shown in drawing 9 , the 1st arm 51 is supported pivotably to the 1st eccentric shaft 50, and the 2nd arm 53 is supported pivotably by the opposite hand to the 2nd eccentric shaft 52 in the 1st arm 51. Moreover, rollers 54 and 55 are formed at the head of both the arms 51 and 53, respectively, and both the rollers 54 and 55 roll the peripheral surface of the common cam 56 for bulb actuation mutually. And when the center of oscillation of the 1st arm biases by rotation of the center of rotation of the 1st eccentric shaft 50, the engaged point of the 1st arm 51 and the cam 51 for bulb actuation biases in the direction of a tooth lead angle. Moreover, the center of oscillation biases by the revolution of the 2nd eccentric shaft 52, and the engaged point of the 2nd arm 53 and the cam 56 for bulb actuation biases in the direction of the angle of delay. Therefore, a working angle can be made to change into arbitration with this technique, when one of the eccentric shafts 50 and 52 rotates at least, and an engaged point with one of the arms 51 and 53 biases at least with the cam 56 for bulb actuation. In addition, the tappet which drives 57 in drawing by arms 51 and 53, and 58 are push rods.
[0003] Moreover, in JP,62-137314,U, as shown in drawing 10 R> 0, the 1st eccentric shaft 60 and the 2nd eccentric shaft 62 are formed in the both-sides side of Rota 59, and the 1st arm 61 and 2nd arm 63 are supported pivotably by both the shafts 60 and 62 rotatable, respectively. Rollers 64 and 65 are formed at the head of both the arms 61 and 63, respectively, and both the rollers 64 and 65 roll the peripheral surface of the common cam 66 for bulb actuation mutually. And when the center of oscillation of the 1st arm 61 biases by rotation of the center of rotation of the 1st eccentric shaft 60, the engaged point of the 1st arm 61 and the cam 66 for bulb actuation biases in the direction of a tooth lead angle. Moreover, the center of oscillation biases by the revolution of the 2nd eccentric shaft 62, and the engaged point of the 2nd arm 63 and the cam 66 for bulb actuation biases in the direction of the angle of delay.
[0004] And the 1st eccentric shaft 60 and the 2nd eccentric shaft 62 are formed in the both-sides side of Rota 59, and the center of rotation of the 1st eccentric shaft 60 and the center of rotation of the 2nd eccentric shaft 62 are established in same axle. Furthermore, the 1st eccentric shaft 60 and the 2nd eccentric shaft 62 are arranged to Rota 59 in the location where the center of oscillation of the 1st arm 61 and the center of oscillation of the 2nd arm 63 oppose across a center of rotation. In addition, the tappet which drives 67 in drawing by arms 61 and 63, and 68 are push rods.
[0005] Therefore, a working angle can be made to change into arbitration, when the eccentric shafts 60 and 62 rotate also in this technique, and the engaged point of the cam 66 for bulb actuation and arms 61 and 63 biases.
[0006]
[Problem(s) to be Solved by the Invention] However, when the roller which the path clearance between a roller and the cam for bulb actuation will change, and will be displaced if the roller formed at the head of an arm that it should move to a tooth-lead-angle or angle-of-delay side is displaced overcame the interference section of a cam, since a flat surface, the contact surface of a tappet had the problem which a sound generates.

[0007] Moreover, as shown in drawing 10 (a), when between the axial centers of rollers 64 and 65 is extended and a working angle is extended, while becoming discontinuous and not acquiring a smooth lift property as a lift curve shows drawing 11 in case the cam nose of the cam 66 for bulb actuation moves to a roller 65 from a roller 64, there is also a problem which a sound generates in the discontinuous part. Furthermore, since only a part for a roller to displace shifted from a bulb core as conventionally shown in drawing 9 and drawing 10 , the tappets 57 and 67 which have a large contact area were needed. For this reason, the inertial mass in bulb actuation increased and there was also a problem on which maneuverability gets worse.
[0008] Moreover, as shown in drawing 10 (a), distance (a-b) with the point of contact b of the center of oscillation a of an arm, the cam 66 for bulb actuation, and rollers 64 and 65, and the center of oscillation a of an arm and the distance (a-c) with the tappet point of contact c are factors which determine the amount of lifts. Although the amount of lifts could be changed by changing this (a-b)/(a-c) (= arm ratio), even if it displaced the roller in this Prior art, since distance (a-b) and distance (a-c) hardly changed (i.e., since an arm ratio hardly changes), most amounts of lifts were what not changing.
[0009] It is in the object of this invention offering the adjustable valve gear of the internal combustion engine having a working angle which is different while having a smooth lift curve moreover, without being accompanied by the increment in the inertial mass of a moving part by changing the engagement timing of the rocker arm in a lift period, and a cam by being able to secure the periodicity of a lift property and changing the revolution phase of an eccentric shaft.
[0010]
[Means for Solving the Problem] As opposed to the swinging arm with which this invention has been arranged between a rocker arm and a cam while the end was supported with the eccentric shaft in order to solve the above-mentioned trouble A rocker arm, In the adjustable valve gear of the rocker arm method with which the sliding section which can contact slide on both cam has been arranged Let things be summaries for having had a synchronous revolution means to carry out the synchronous revolution of said eccentric shaft with the cam shaft of said cam, and a phase adjustable means to change the revolution phase of said eccentric shaft to a predetermined phase.
[0011]
[Function] The synchronous revolution of a cam and the rocker arm is carried out with a synchronous revolution means by the above-mentioned configuration. And the swinging arm eccentricity was carried out [the swinging arm] by the revolution of a cam through the sliding section is rocked. If the synchronous revolution of a cam and the rocker arm is carried out where the revolution phase of an eccentric shaft is changed with a phase adjustable means, a swinging arm will be rocked by the revolution of a cam so that the time of clausilium etc. may be changed [before changing a revolution phase] at the time of valve-opening initiation.
[0012]
[Example] Hereafter, the first example which materialized this invention to the adjustable valve gear for the intake valve of a gasoline engine and an exhaust air bulb is explained according to drawing 1 - drawing 6 .
[0013] Drawing 1 shows the movable valve system of the engine in which an important section is shown. In addition, since the intake valve side and exhaust air bulb side of the configuration of a movable valve system is also the same, drawing 1 shows the device by the side of an inlet valve, and the device by the side of an exhaust valve omits the explanation.
[0014] As for this movable valve system, the swinging arm 2 and the rocker arm 3 are supported rotatable to the rocker shaft 1. a swinging arm 2 -- a rocker shaft 1 -- setting -- mutual -- alienation -- it consists of arm pieces 4 of the arranged couple. Eccentric shank 1a estranged mutually is formed in the rocker shaft 1. To the eccentric shank 1a, each arm piece 4 is arranged pivotable, to the revolving-shaft alignment n of a rocker shaft 1, eccentricity of the revolving-shaft alignment m is carried out, and it is arranged. A shaft 5 is constructed between the heads of the arm piece 4, and the needle roller 6 is supported rotatable to the same axle 5. The press roller 7 of a couple is supported by the shaft 5 rotatable between the both-sides side of said needle roller 6, and the arm piece 4. This press roller 7 is formed in the minor diameter a little rather than said needle roller 6. The sliding section is constituted by said needle roller 6 and press roller 7.
[0015] Let the revolving-shaft alignment of a rocker arm 3 be the revolving-shaft alignment n and the same axle of said rocker shaft 1. At the head of a rocker arm 3, the driving member 9 which presses a tappet 8 caudad projects caudad. Above the rocker arm 3, the inspired air flow path cam shaft 10 is arranged at a rocker shaft 1 and parallel. The cam 11 is formed in the needle roller 6 and the corresponding location in this cam shaft 10. The central top face of said rocker arm 3 is formed in the cross-section radii-like curved

surface 12, and the curved surface 12 is arranged on the circle of the radius R centering on the revolving-shaft alignment O of a cam shaft 10, i.e., the revolving-shaft alignment of a cam 11. And the press roller 7 of a swinging arm 2 is laid possible [rolling] on this curved surface 12. Moreover, a long hole 13 is formed in the center section of said rocker arm 3 possible [insertion of said needle roller 6], and migration of a needle roller 6 is permitted at the time of displacement of a swinging arm 2.

[0016] Moreover, said tappet 8 drives the inhalation-of-air valve stem which is not illustrated in the vertical direction. Next, the drive of the rocker shaft 1 which is a synchronous revolution means in this example is explained according to drawing 3 .

[0017] Actuation connection of the timing pulleys 18 and 19 formed in the edge of the inspired air flow path cam shaft 10 and the exhaust side cam shaft 17 is carried out at the sprocket 16 prepared in the edge of a crankshaft 15 through the timing belt 21. If a crankshaft 15 rotates the timing pulleys 18 and 19 one time by this actuation connection, it will rotate 1/2. Said sprocket 16 and timing pulley 20 of the diameter of said are formed in the edge of said inspired air flow path cam shaft 10.

[0018] timing pulley ashy which constitutes the adjustable valve timing device (only henceforth "VVT") as a phase adjustable means -- 22 is equipped with the configuration of a well-known helical spline type. timing pulley ashy 22 is equipped with the timing pulleys 18 and 19, the first pulley 27 of the diameter of said, and the second pulley 28, and both the pulleys 27 and 28 are arranged on the same axle -- having -- an internal device -- minding -- the same direction -- a synchronization -- it is pivotable. and timing pulley ashy -- when an internal device drives 22 with oil pressure etc., **** [pulley / 28 / second] centering on shaft orientations is relatively given to the first pulley 27. this timing pulley ashy 22 [and] -- 45 degrees -- it can twist and can give.

[0019] said timing pulley 20 -- timing pulley ashy -- actuation connection is carried out through the timing belt 21 to the first pulley 27 of 22. Moreover, the timing pulleys 24 and 25 which are 1/2 paths of said second pulley 28 are formed in the end of the inspired air flow path rocker shaft 1 and the exhaust side rocker shaft 23, and actuation connection of both the timing pulleys 24 and 25 is carried out to said second pulley 28 of timing pulley ashy 22 through the timing belt 26.

[0020] Therefore, when **** centering on the shaft orientations of the second pulley 27 which got into gear to the timing belt 26 is given, **** is given to the timing pulleys 24 and 25 through a timing belt 26 as the result. And the closing motion timing of an intake valve and an exhaust air bulb is changed by giving **** to rocker shafts 1 and 23. And if the sprocket 16 of a crankshaft 15 rotates one time as described above, 1/4 revolution and the timing pulleys 24 and 25 will rotate [the timing pulleys 18 and 19 / the second pulley 27 and 28] 1/2 1/2 revolution and for a start, respectively. namely, the inspired air flow path and the exhaust side cam shafts 10 and 17 which were connected with the timing pulleys 18 and 19, and the inspired air flow path and the exhaust side rocker shafts 1 and 23 which were connected with the timing pulleys 24 and 25 -- a synchronization -- it is pivotable.

[0021] and timing pulley ashy -- a center of rotation n is able to displace to a 90-degree angle-of-delay side rather than the object for high speeds, as it is indicated in drawing 2 as the object for high speeds to which the center of rotation m of a swinging arm 2 is located in right-hand side (tooth-lead-angle side) in drawing 1 from the center of rotation n of the second rocker arm 3 by driving 22. In addition, 29 and 30 are idle rollers among drawing 3 , respectively.

[0022] Now, an operation of the example constituted as mentioned above is explained. Drawing 2 shows the adjustable valve gear in the condition of obtaining the lift curve for low speeds. timing pulley ashy which constitutes VVT when the cam 11 and the rocker shaft 1 are rotating by this revolution in this condition and it obtains the lift curve for high speeds from this condition -- 22 is driven with oil pressure etc. Then, **** centering on shaft orientations is relatively given to the second pulley 28 to the first pulley 27. Therefore, the timing pulleys 24 and 25 rotate, respectively and rocker shafts 1 and 23 rotate. At this time, a cam 11 and rocker shafts 1 and 23 are made by transfer of 1:1. Consequently, as shown in drawing 1 , the center of rotation m of a swinging arm 2 is located in right-hand side (tooth-lead-angle side) in drawing 1 from the center of rotation n of a rocker arm 3. If it drives from [which a cam 11 begins to open in this condition] P, a needle roller 11 will move so that it may pass through the location shown by 6a, 6b, and 6c as shown in drawing 5 . 6a is a location at the time of valve-opening initiation, and a location when 6b is driven by the cam 11 and a lift is carried out to a peak, and 6c are the locations at the time of clausilium. And as shown in the continuous line of drawing 4 R> 4, the big working angle A and the amount of lifts can be obtained greatly.

[0023] When obtaining the lift curve for low speeds from the condition of obtaining the lift curve for said high speeds, VVT is driven with oil pressure etc. Then, **** centering on shaft orientations is relatively

'given to the second pulley 28 to the first pulley 27. Therefore, the timing pulleys 24 and 25 rotate, respectively and rocker shafts 1 and 23 rotate. At this time, a cam 11 and rocker shafts 1 and 23 are made by transfer of 1:1. Consequently, as shown in drawing 2 , the center of rotation m of a swinging arm 2 is located in an angle-of-delay side from the condition of drawing 1 . It drives from [which a cam 11 begins to open in this condition] P, and if a needle roller 6 is moved to the location most estranged from the center of oscillation when a cam nose contacts a needle roller 6, as the object for low speeds is shown in drawing 6 , a needle roller 6 will move so that it may pass through the location shown by 6d and 6e. 6d is a location at the time of valve-opening initiation and clausilium, and 6e is a location when it drives by the cam 11 and a lift is carried out to a peak. The location of this 6e is also a location where a needle roller 6 makes a U-turn. And as shown in the dotted line of drawing 4 , the small working angle B and the amount of lifts can be obtained small. therefore, the part in which, as for the maximum lift, the arm ratio fell in this object for low speeds -- since it becomes small and compression of a valve spring becomes small, friction can be lowered. For this reason, fuel consumption can be improved.

[0024] In said example, as shown in drawing 2 , the variation rate of the object for low speeds was carried out 90 degrees to the case for the high speeds which the center of oscillation m shows to drawing 1 , but as shown in drawing 7 rather than the case for high speeds, it may be made to carry out a variation rate 180 degrees. In this case, VVT is realized by using a 90 degree adjustable type thing. Or VVT is possible also by using a 45 degree adjustable type thing, enlarging the first pulley 27 of VVT, and the second pulley 28, considering as 1/4X from a cam to VVT, and making it 4X from VVT to rocker shafts 1 and 23. In the example of this drawing 7 , in order that a needle roller 6 may move in the direction of Q, as the two-dot chain line of drawing 4 shows, it will begin to open late, the valve will be closed early, and if it drives from [which a cam 11 begins to open] P, although the amount of lifts does not change to high speeds, the working angle C will become small.

[0025] As mentioned above, since a discontinuous part does not exist in a lift curve when changing the phase of the center of oscillation m of a swinging arm 2, a sound does not occur and a smooth lift property can be acquired. Moreover, in this example, in order not to displace the driving member 9 which contacts a tappet 8, it becomes good by the tappet of a narrow contact area, i.e., a small tappet, an inertial mass does not increase, and maneuverability does not get worse.

[0026] Next, the second example is explained. In this example, as shown in drawing 8 , during the configuration of said first example, in the rocker arm 3, a part of head of the curved surface 12 on the circle of the radius R centering on the revolving-shaft alignment O of a cam 11 was cut smoothly, and lift relief side 12a was formed, and it is smoothly connected to the curved surface 12. And this lift relief side 12a is formed corresponding to near including the location (location where a needle roller 6 makes a U-turn) of 6e shown in drawing 6 equipped with the lift curve for the low speeds of said first example.

[0027] In this example, as shown in drawing 8 , the center of rotation m of a swinging arm 2 is located in an angle-of-delay side from the condition of drawing 1 , in order to obtain the lift curve for low speeds like the first example. In this condition, it drives from [which a cam 11 begins to open] P, and when a cam nose contacts a needle roller 6, a needle roller 6 is moved to the location most estranged from the center of oscillation. Then, as shown in drawing 6 , a needle roller 6 moves so that it may pass through the location shown by 6d and 6e. And a needle roller 6 carries out press actuation of the rocker arm 3 in lift relief side 12a near the 6e which is the location which obtains the amount of the maximum lifts. For this reason, the amount of the maximum lifts becomes what has the small amount of the maximum lifts as compared with the lift curve for the low speeds of the first example, as the alternate long and short dash line alpha of drawing 4 shows, and the working angle B becomes the same as the first example. Consequently, friction can be reduced.

[0028] In addition, it is also possible to change into arbitration in the range which this invention is not limited to said example and does not deviate from the meaning of this invention.

(1) In said example, although shape was taken to the gasoline engine, shape can also be taken to a diesel power plant.

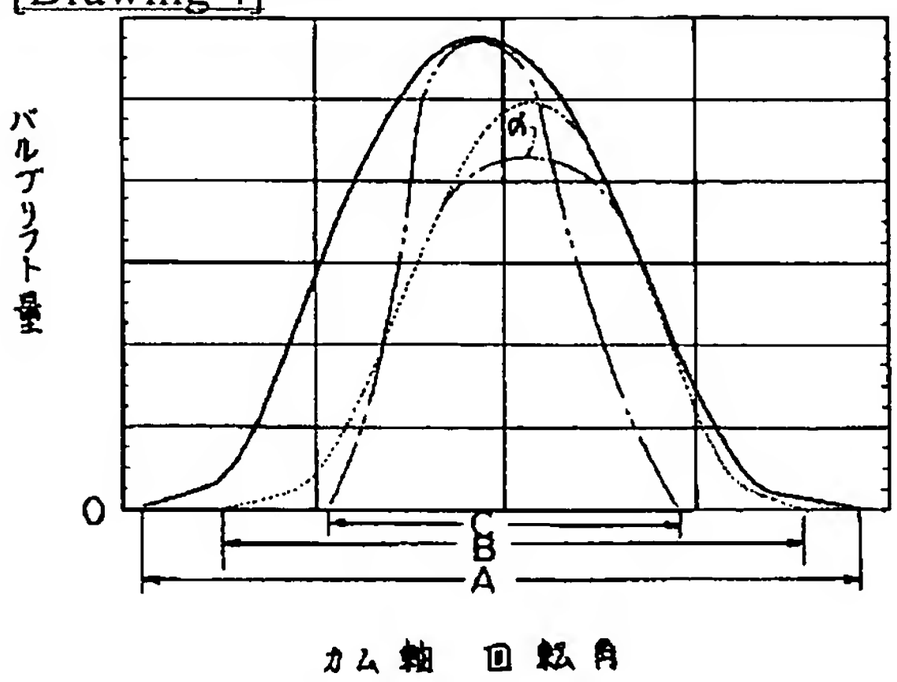
[0029]

[Effect of the Invention] As explained in full detail above, it is not accompanied by the increment in the inertial mass of a moving part by changing the engagement timing of the rocker arm in a lift period, and a cam by being able to secure the periodicity of a lift property according to this invention, and changing the revolution phase of an eccentric shaft. And while being able to obtain a smooth lift curve, the outstanding effectiveness that the lift curve equipped with a different working angle can be obtained is done so.

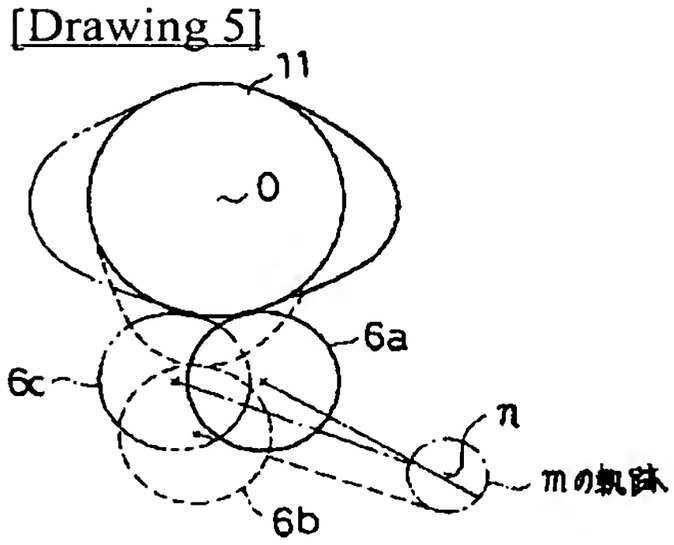
[Translation done.]

DRAWINGS

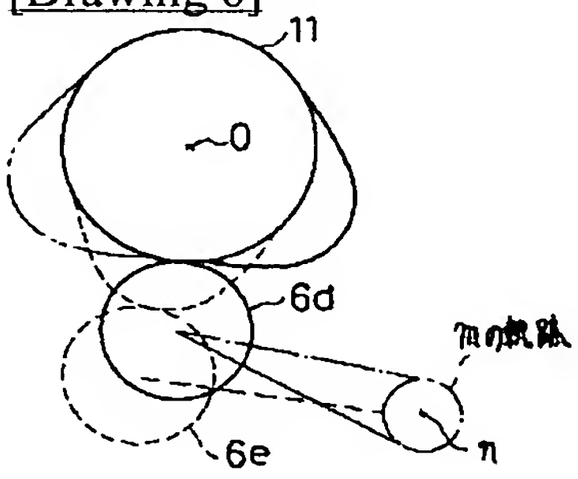
[Drawing 4]



[Drawing 5]

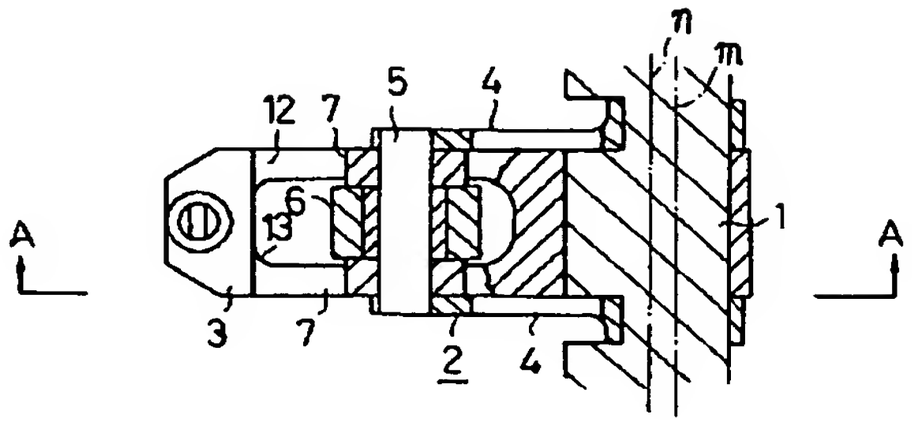


[Drawing 6]



[Drawing 1]

(a)



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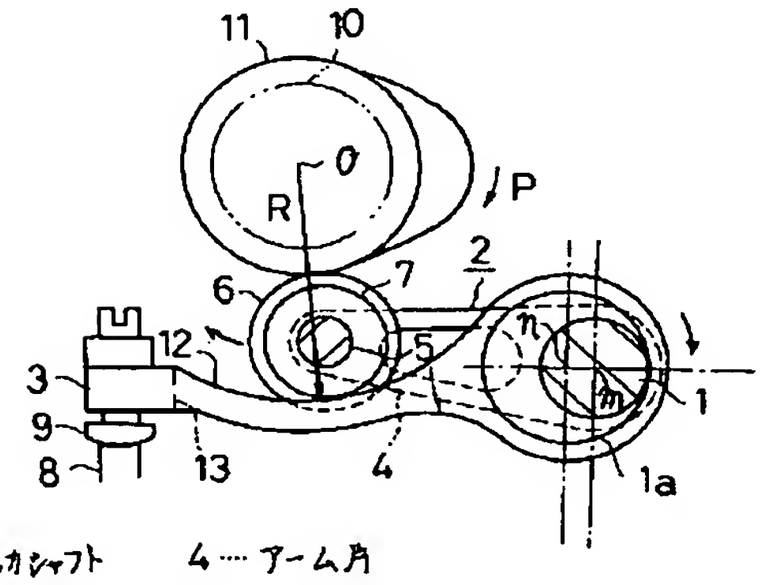
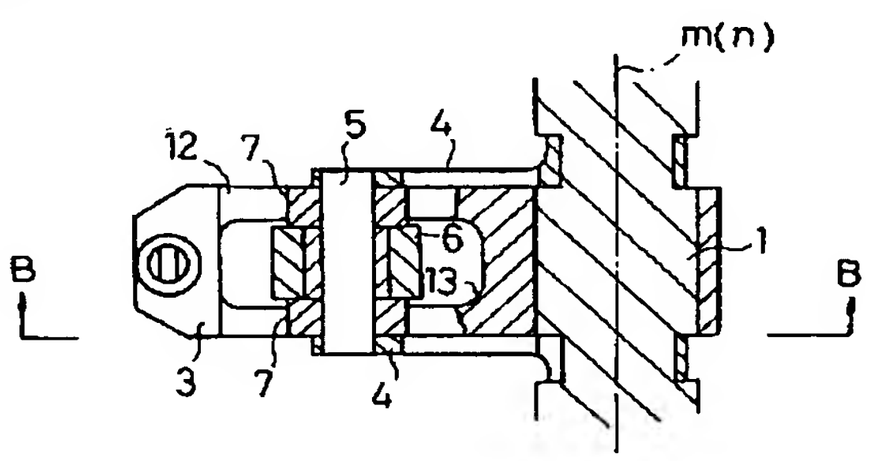


1 … ロッカシャフト　4 … アーム片
2 … 揺動アーム　6 … ニードルローラ
3 … ロッカアーム　7 … 揺圧ローラ

[Drawing 2]

(a)



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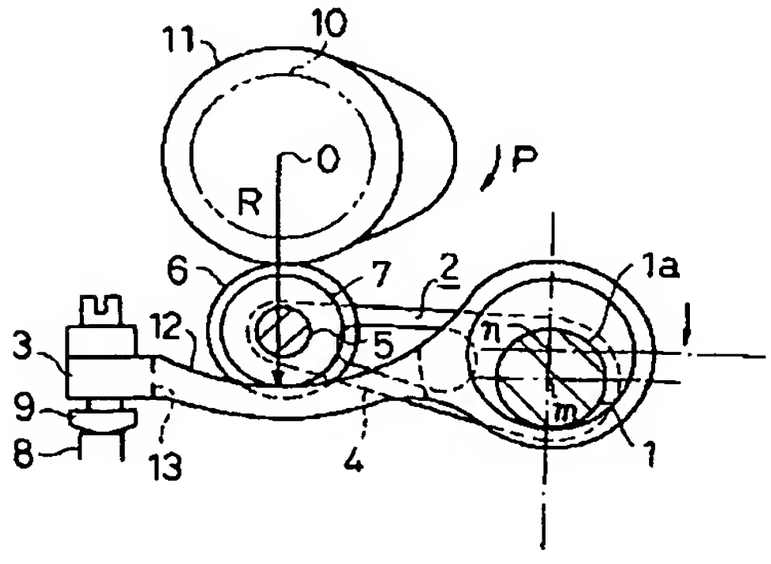
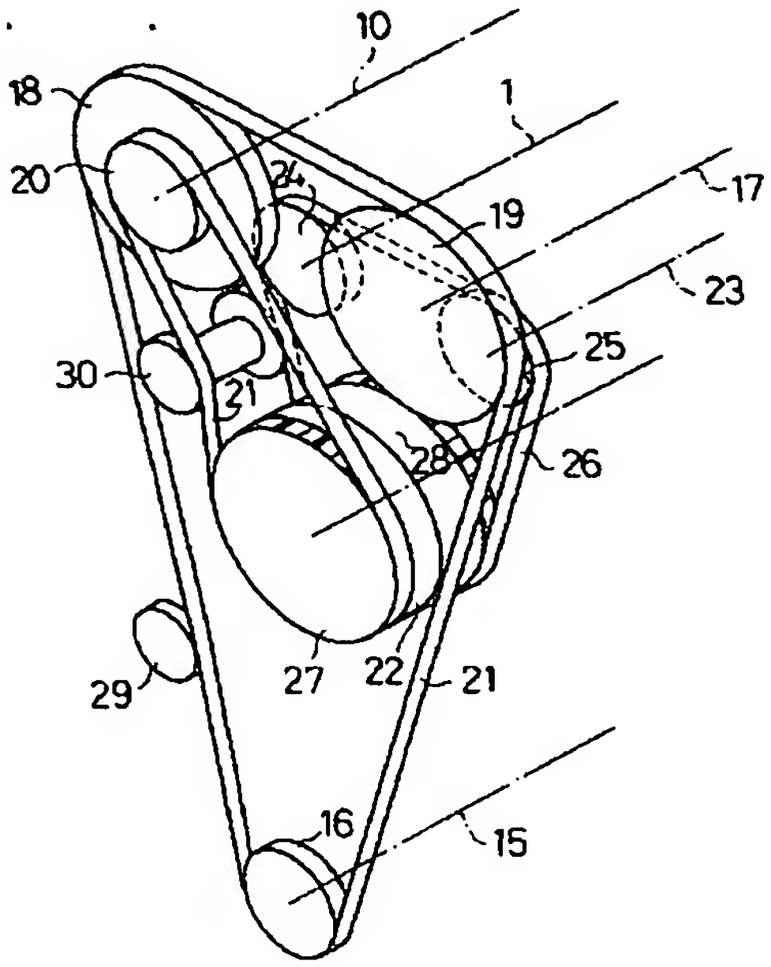
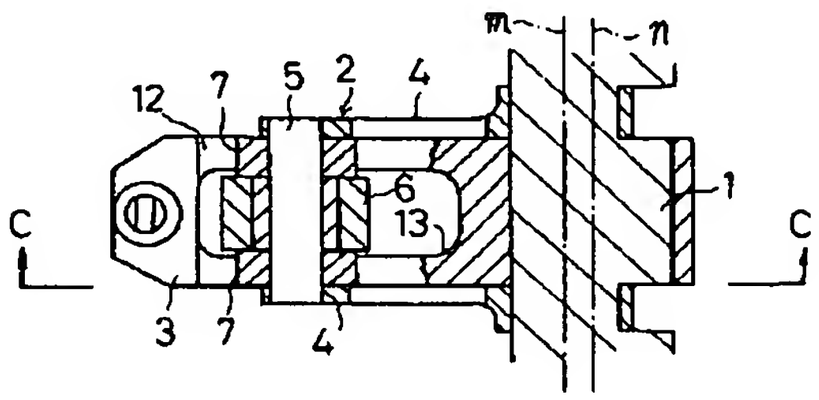


[Drawing 3]



[Drawing 7]
(a)



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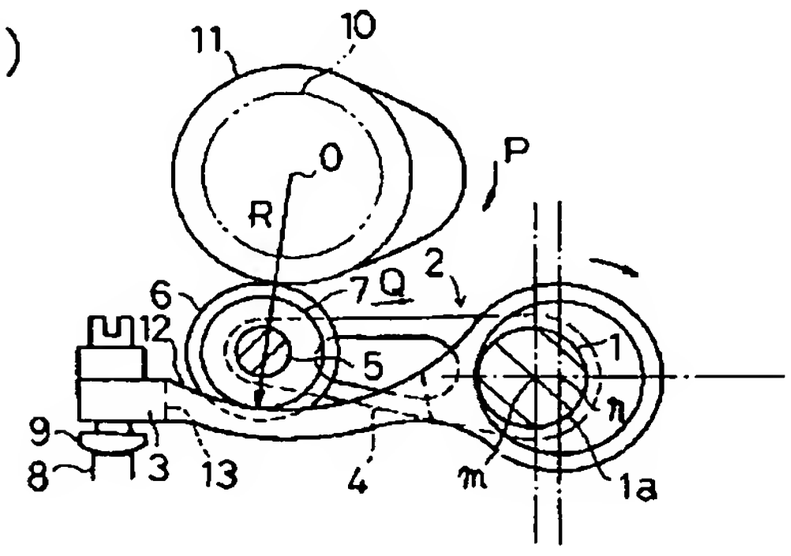
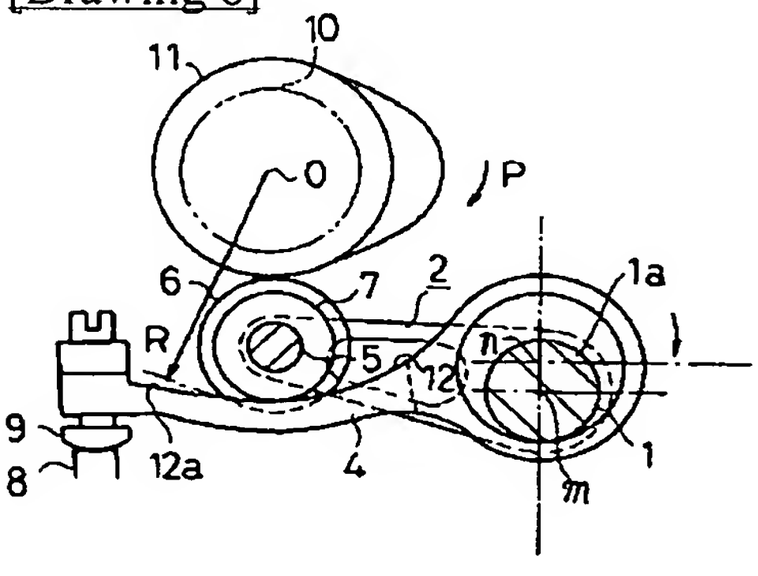
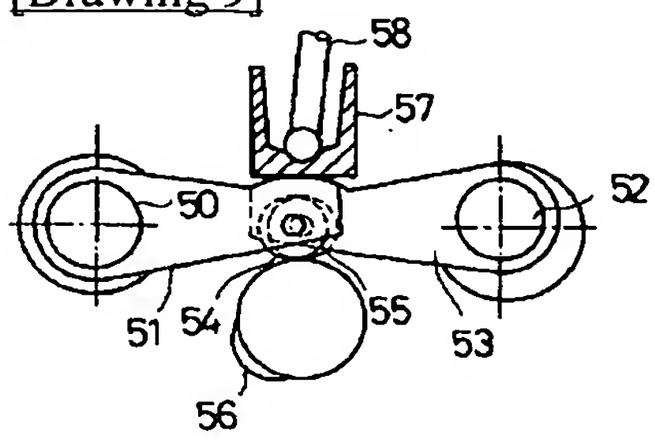


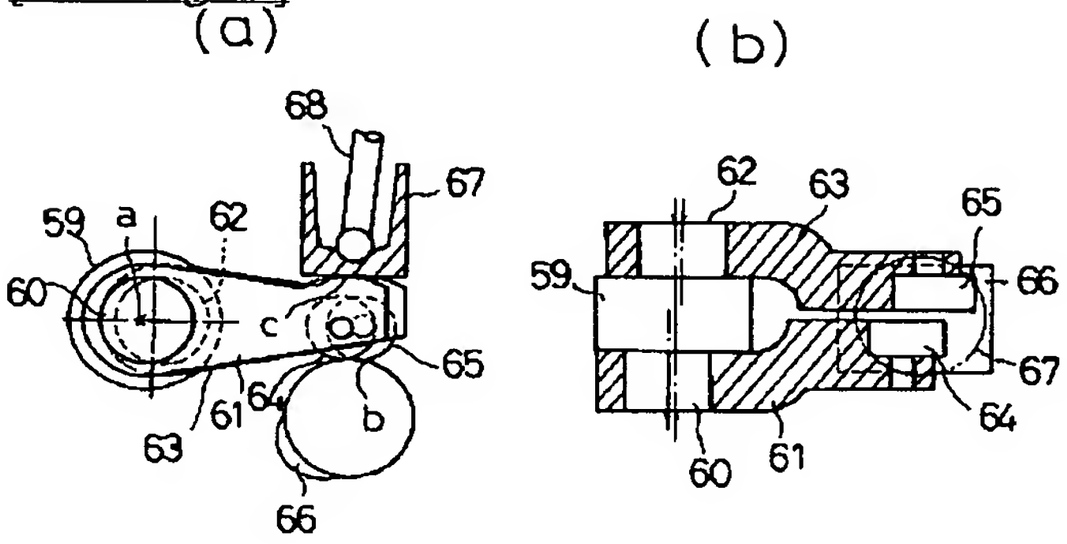
[Drawing 8]



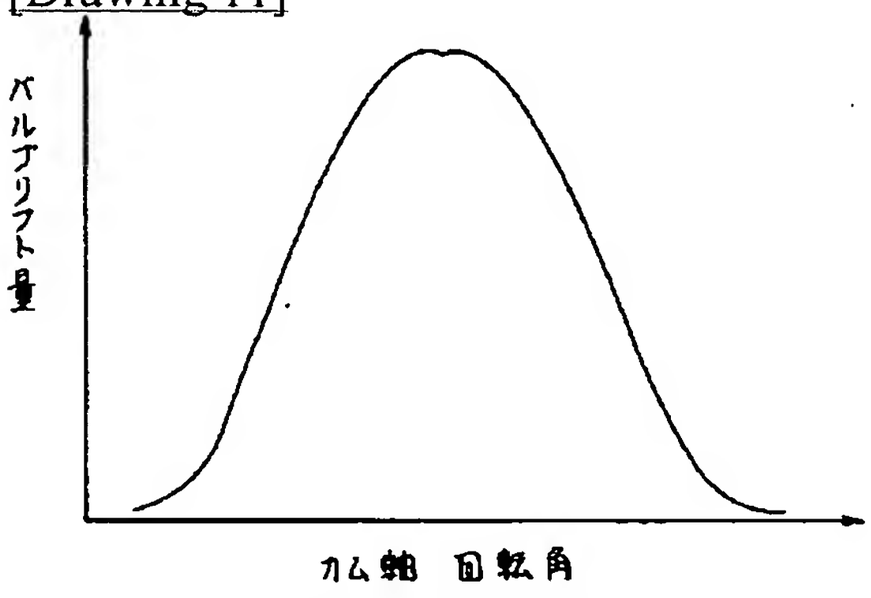
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]

WRITTEN AMENDMENT

---------- [procedure amendment]
[Filing Date] October 14, Heisei 5
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] drawing 8
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 8] It is the sectional side elevation of other examples.

[Translation done.]